SPC Literary Review

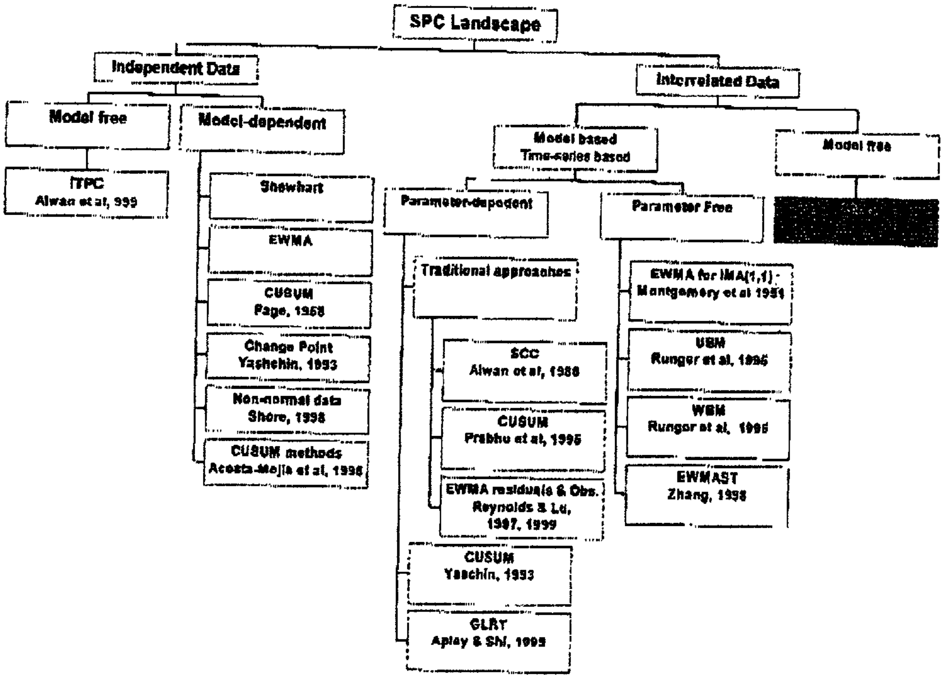

Figure 1: SPC Characterization methods

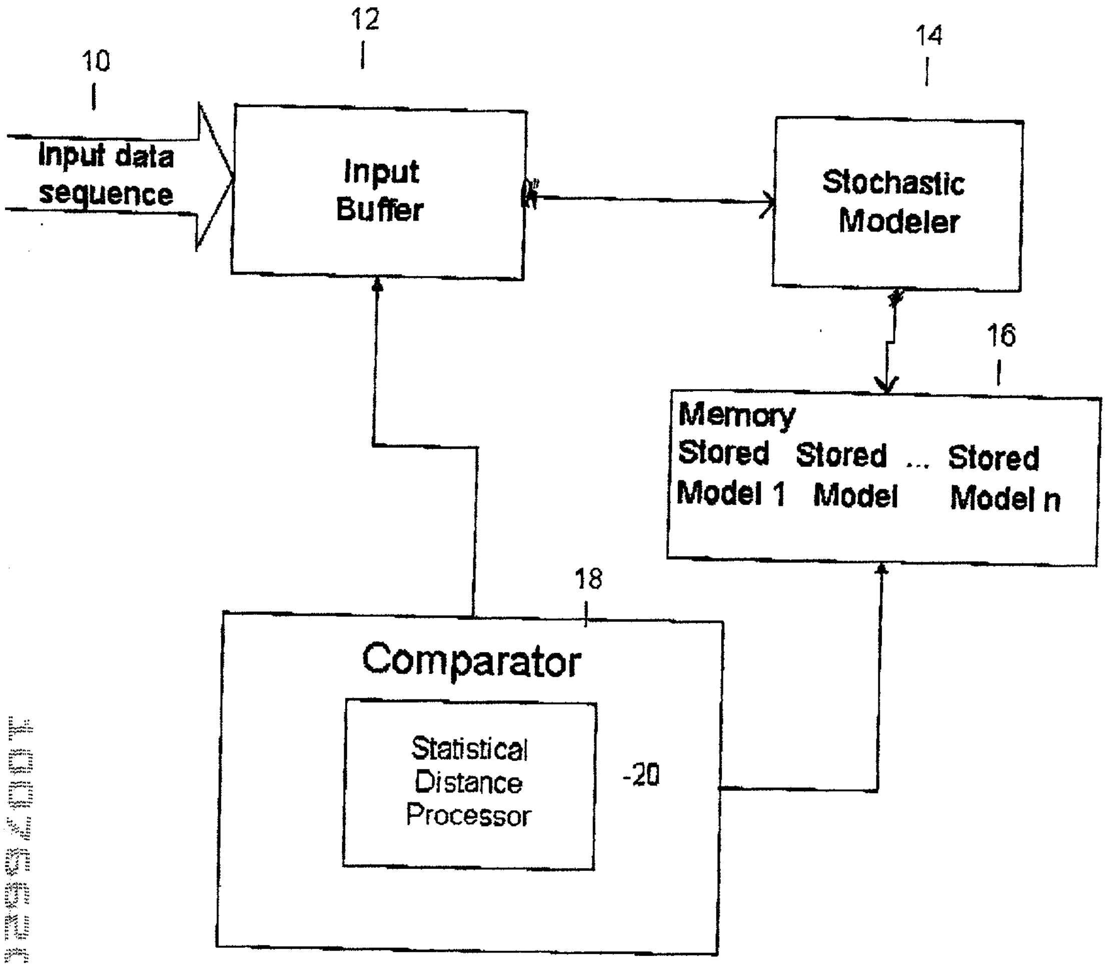
10
Input data sequence
12
Input Buffer
14
Stochastic Modeler
16
Memory
Stored Model 1
Stored Model
...
Stored Model n
18
Comparator
Statistical Distance Processor
-20

Fig. 2

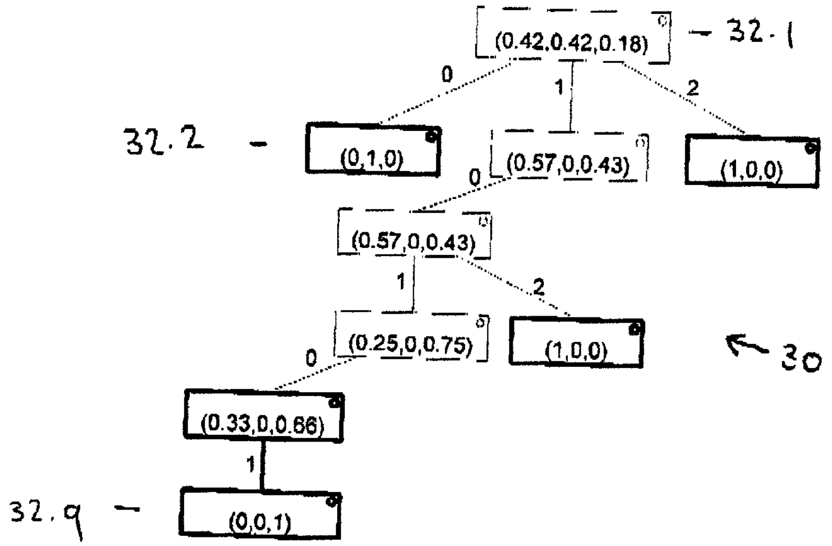
(0.42,0.42,0.18)
32.1
0
1
2
32.2
(0,1,0)
(0.57,0,0.43)
(1,0,0)
0
(0.57,0,0.43)
1
2
(0.25,0,0.75)
(1,0,0)
30
0
(0.33,0,0.66)
1
32.9
(0,0,1)

Fig. 3

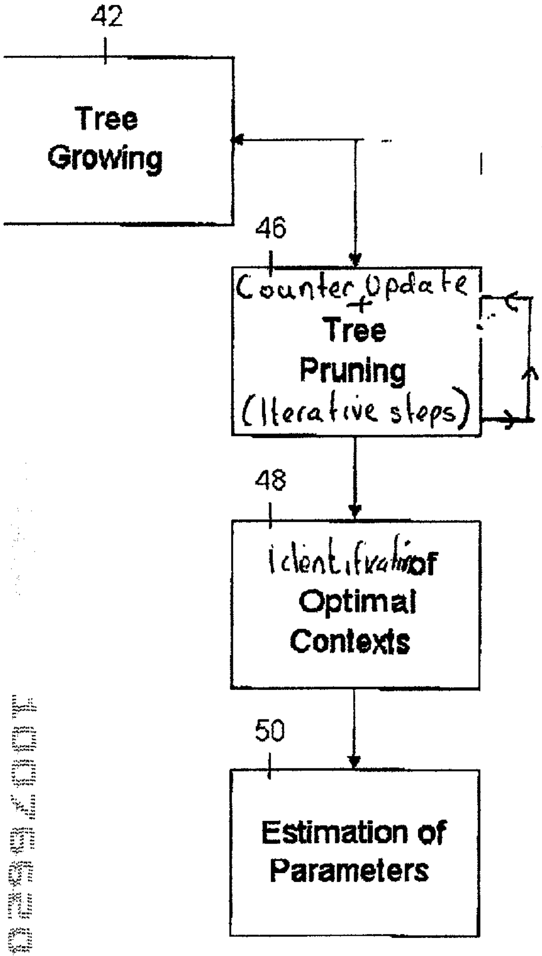
42
Tree Growing
46
Counter Update + Tree Pruning (Iterative steps)
48
Identification of Optimal Contexts
50
Estimation of Parameters

Fig. 4

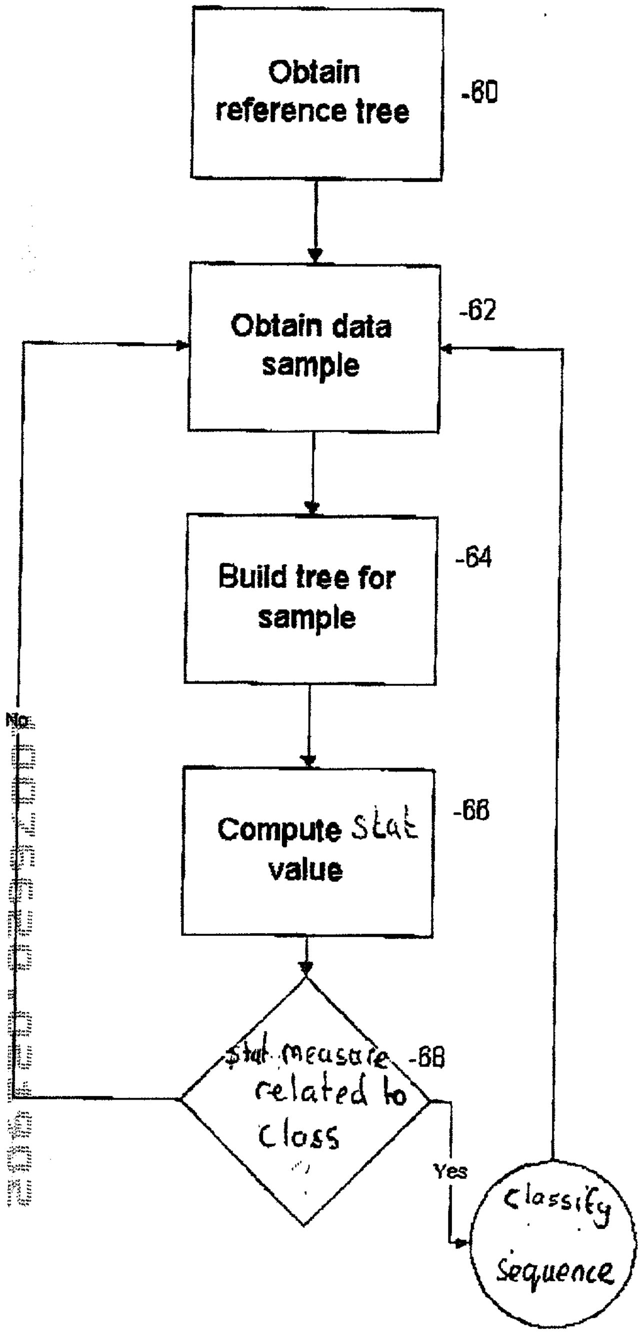
Obtain reference tree
60
Obtain data sample
62
Build tree for sample
64
Compute stat value
66
stat measure related to class
68
No
Yes
classify sequence

Fig. 5A

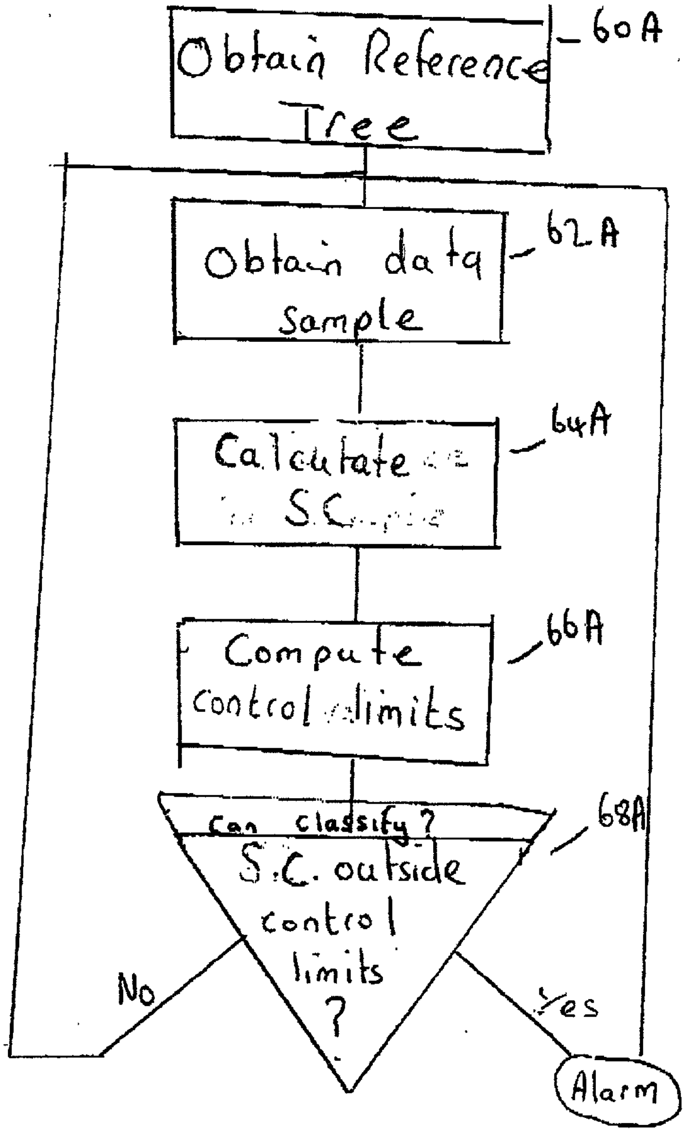
Obtain Reference Tree
60A
Obtain data sample
62A
Calculate S.C.
64A
Compute control limits
66A
Can classify?
S.C. outside control limits ?
68A
No
Yes
Alarm

Fig.5B

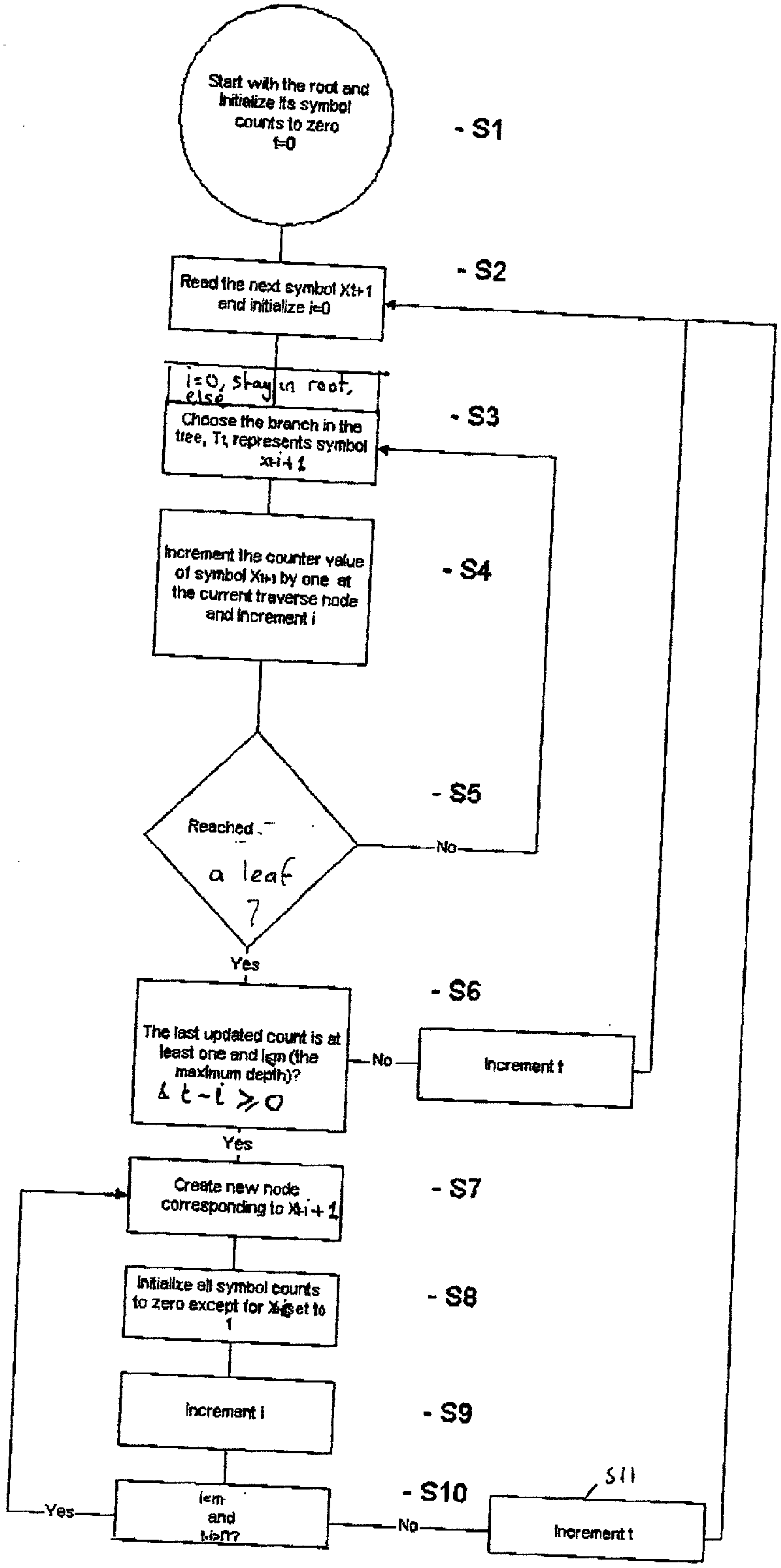
Start with the root and initialize its symbol counts to zero t=0
- S1
Read the next symbol Xt+1 and initialize i=0
- S2
i=0, stay in root, else
Choose the branch in the tree, Tt, represents symbol Xt-i+1
- S3
Increment the counter value of symbol Xt+1 by one at the current traverse node and increment i
- S4
Reached a leaf ?
- S5
No
Yes
The last updated count is at least one and i<m (the maximum depth)? & t-i ≥ 0
- S6
No
Increment t
Yes
Create new node corresponding to Xt-i+1
- S7
Initialize all symbol counts to zero except for Xt-i set to 1
- S8
Increment i
- S9
i<m and t-i≥0?
- S10
Yes
No
S11
Increment t

Fig. 6A

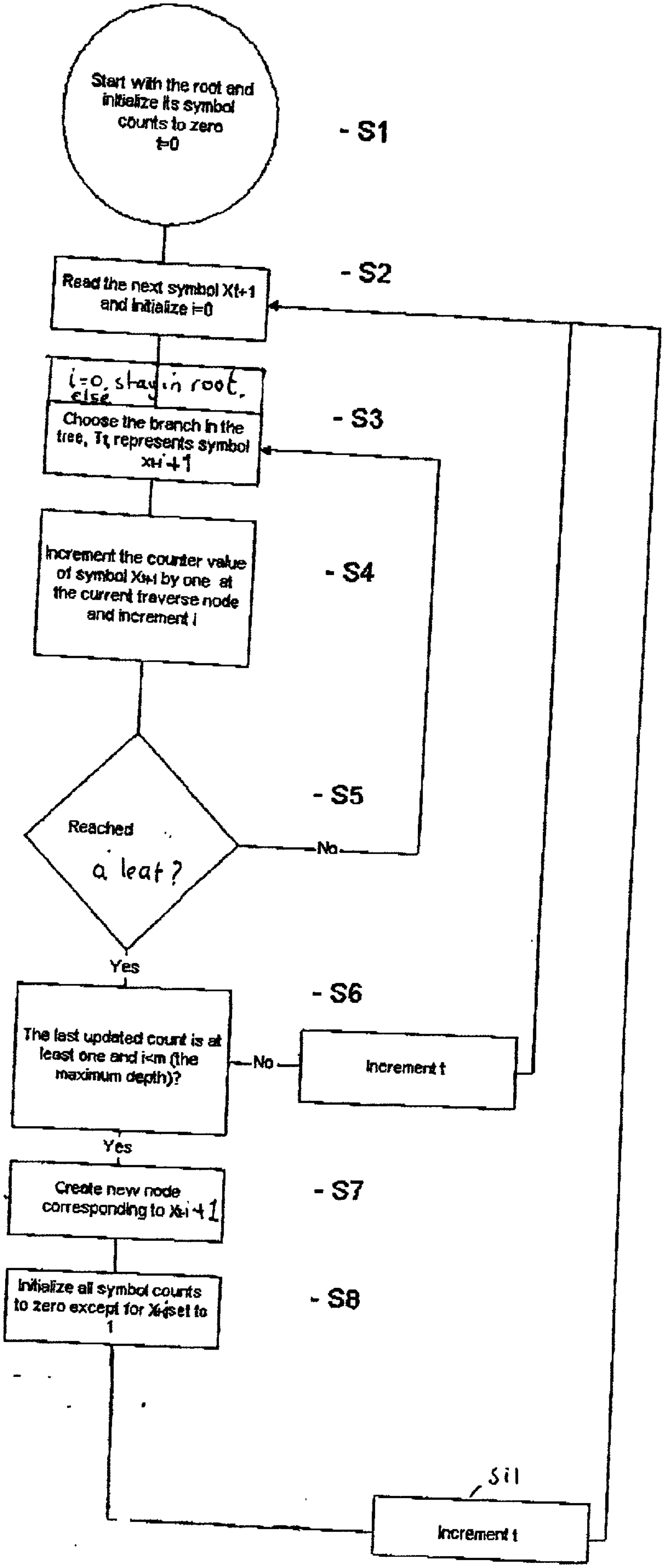
Start with the root and initialize its symbol counts to zero
t=0
- S1
Read the next symbol Xt+1 and initialize i=0
- S2
i=0, stay in root, else
Choose the branch in the tree, Tt represents symbol Xt-i+1
- S3
Increment the counter value of symbol Xt+1 by one at the current traverse node and increment i
- S4
Reached a leaf?
- S5
No
Yes
The last updated count is at least one and i<m (the maximum depth)?
- S6
No
Increment t
Yes
Create new node corresponding to Xt-i+1
- S7
Initialize all symbol counts to zero except for Xt+1 set to 1
- S8
S11
Increment t

Fig 6B

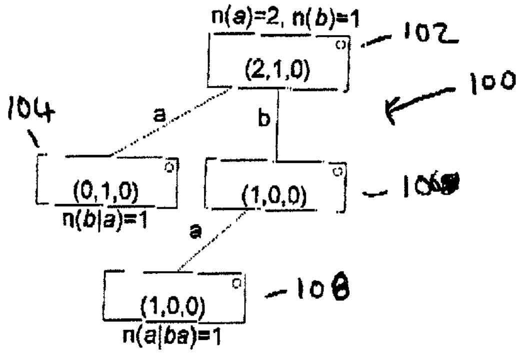

Figure ~~A1~~ 7: the counter context tree constructed from $x_3 = a,b,a$

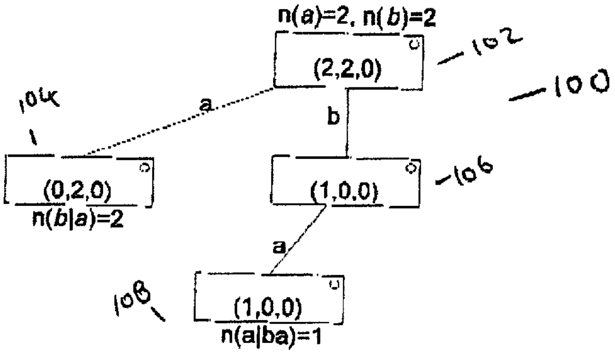

Figure ~~A2:~~ 8 the counter context tree constructed from $x^4 = a,b,a,b$ following Step I.1

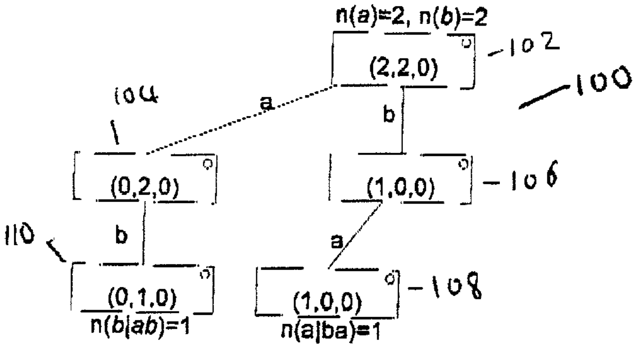

Figure ~~A3:~~ 9 the counter context tree constructed from $x^4 = a,b,a,b$; partial application of Step I.2

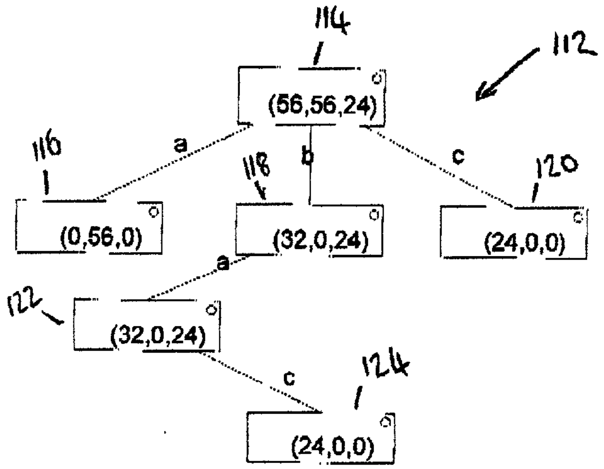

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Figure ~~A4~~: The pruned counter context-tree of the string (a,b,a,b,c,a,b,a,b,c,a,b,a,b,a,b,c) replicated 8 times

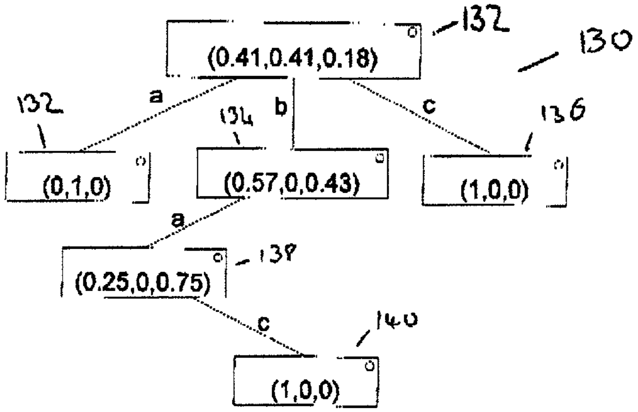

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Figure ~~A5~~: The context tree containing vectors of conditional probabilities $P(x|s)$ as obtained from the counter context-tree in figure A4. Optimal contexts are represented by the bolded frame.

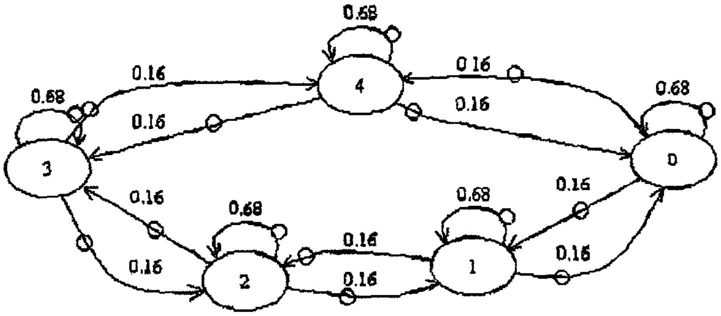

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Figure 6 State transition diagram

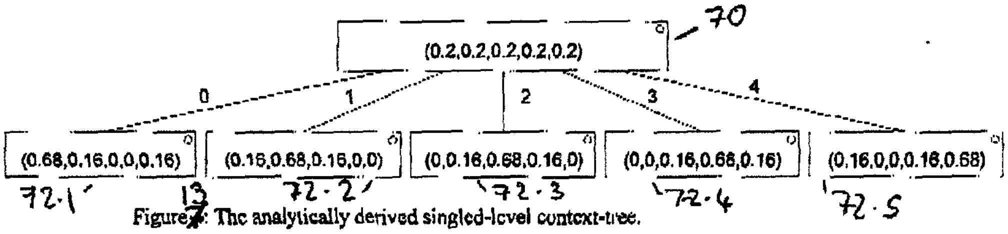

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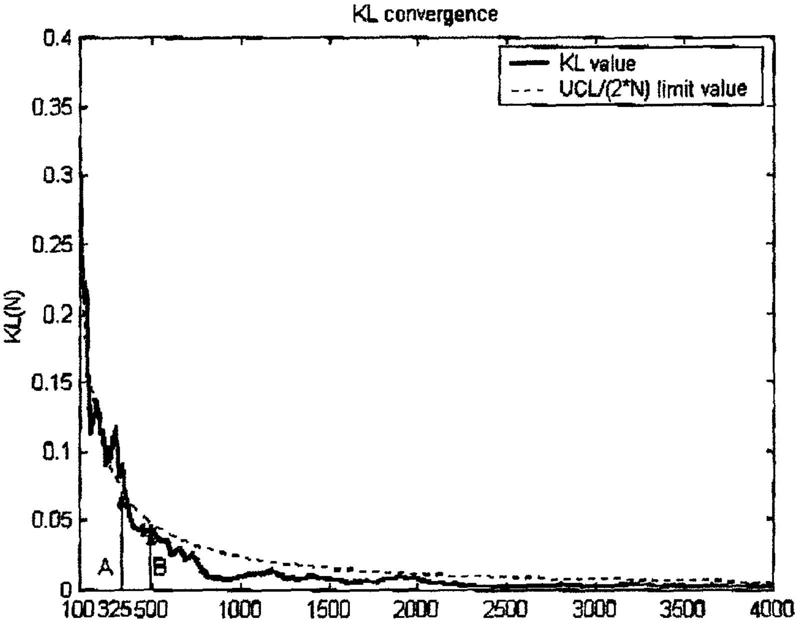
Figure 7: The analytically derived singled-level context-tree.



~~13~~

Figure 8: KL value in relation to input string length N

14

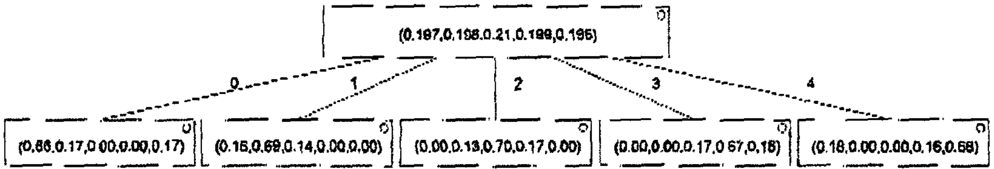


Figure 15: Estimated reference context-tree resulted from the implementation of context algorithm to N=1000

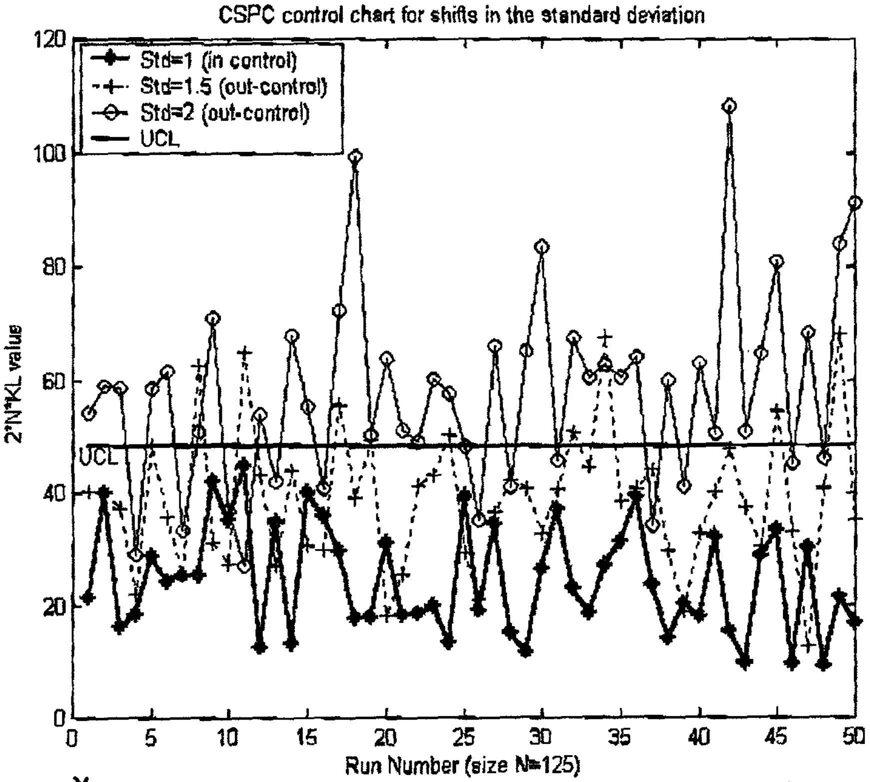


Figure ~~7~~ 16: Shifts in the process underlying normal standard deviation - λ=1, 1.5, 2 (number of runs for each process properties is equal to 50).

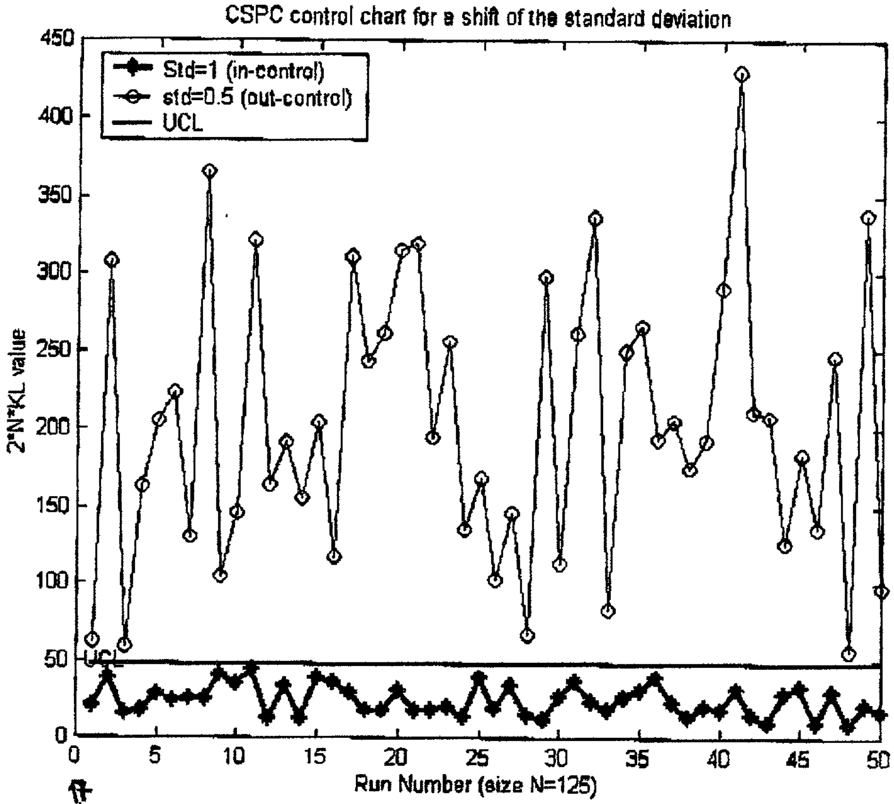


Figure ~~8~~ 11: Shift in the process underlying normal standard deviation – λ=0.5 (number of runs equal to 50)

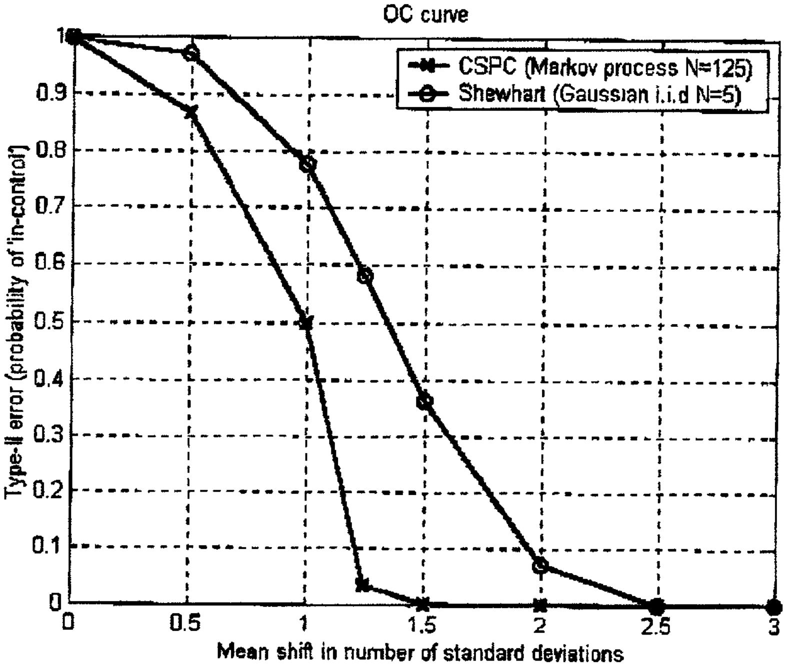


Figure ~~9~~: operating characteristics curve
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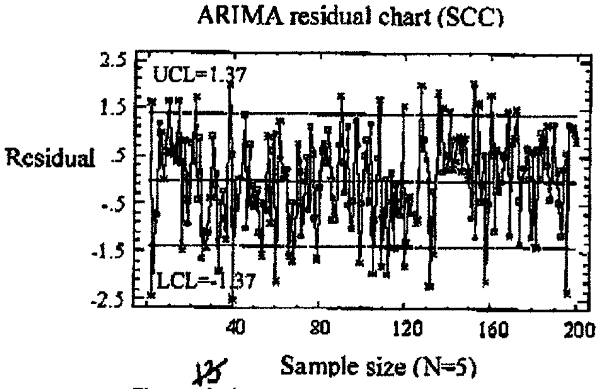

Figure ~~10~~: the SCC control chart for 'in-control' data
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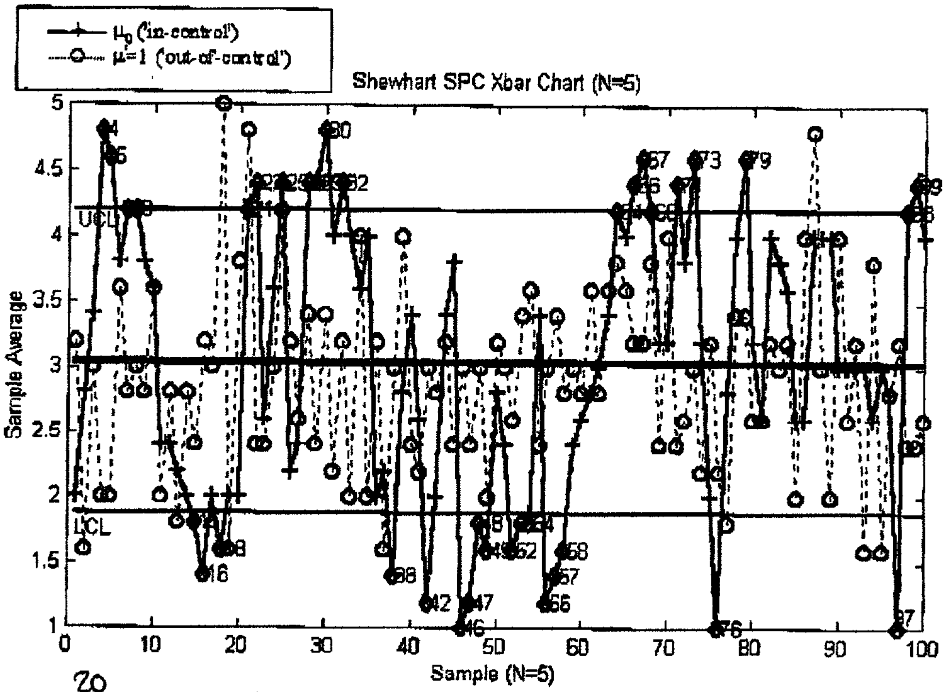

Figure ~~14~~ 20 Shewhart SPC $\overline{X}$ chart - 'in-control' data (solid line) and 'out-of-control' data (thin line)

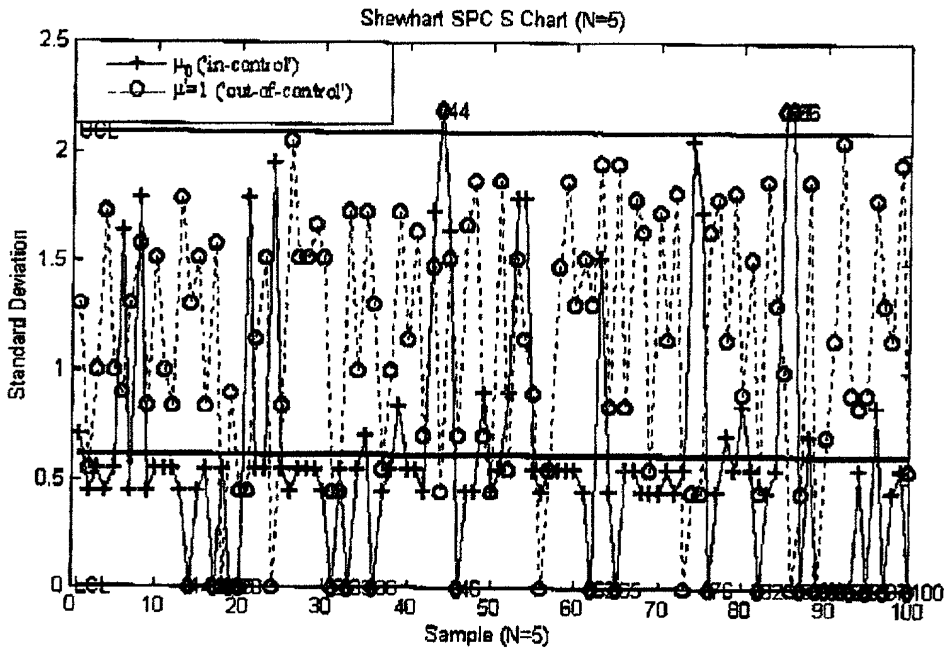

Figure ~~15~~ 21 Shewhart SPC *S*-chart - 'in-control' data (solid line) and 'out-of-control' data (dashed line)

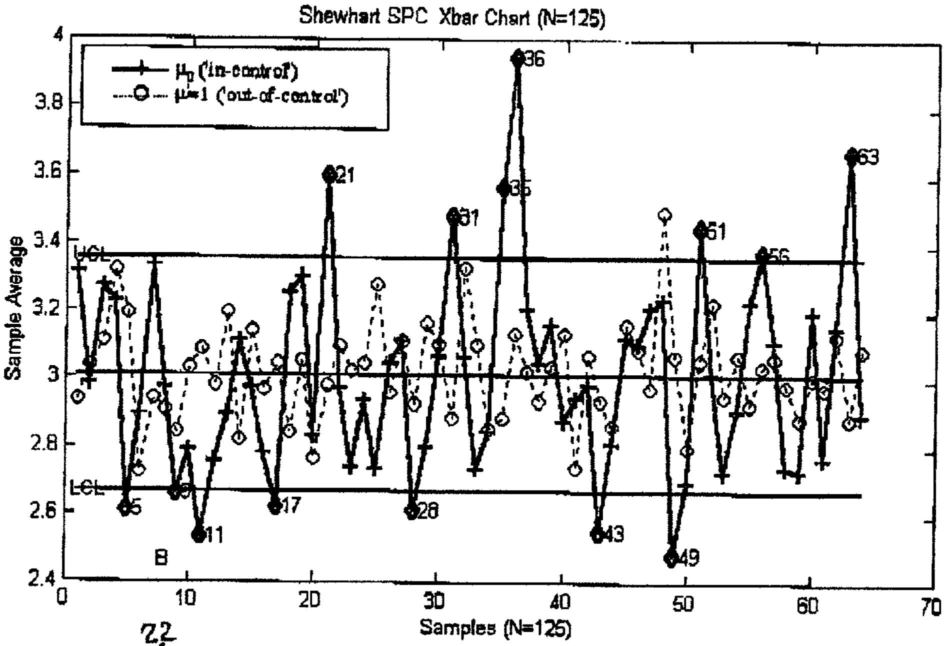

Figure ~~16~~ 22: Shewhart SPC $\overline{X}$ chart for $N=125$ sample size 'in-control' data (solid line) and out of control data (dashed line)

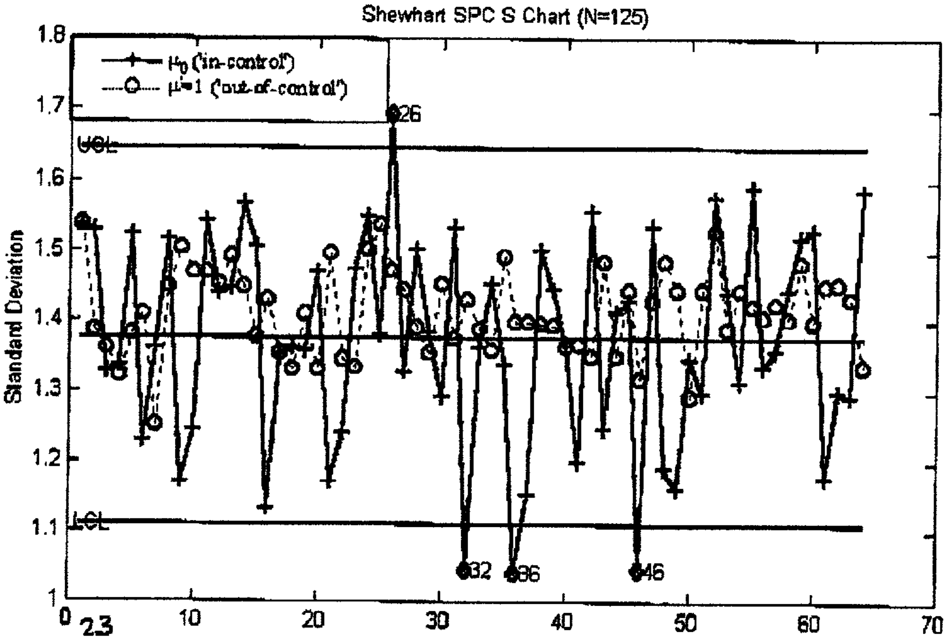

Figure ~~14~~ 23: Shewhart SPC S chart for N=125 sample 'in-control' data (solid line) and out of control data (dashed line)